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Title: **AIR BAG SYSTEM**

PRELIMINARY AMENDMENT-A

Box Patent Applications
Assistant Commissioner for Patents
U.S. Patent and Trademark Office
P.O. Box 2327
Arlington, VA 22202

Sir:

In connection with the above-identified new application (filed concurrently herewith), please amend the above-identified application as follows:

IN THE SPECIFICATION

Please revise the specification as indicated on the appended pages (including clean replacement pages and hand-marked up copies of the original text showing the changes).

IN THE ABSTRACT

Please revise the abstract as indicated on the appended pages (including a clean replacement page and a hand-marked up copy of the original text showing the changes).

IN THE CLAIMS

Please amend original claims 1-17 and add new claims 18-20 as indicated on the appended pages (including clean replacement pages and hand-marked up copies of the original text showing the changes).

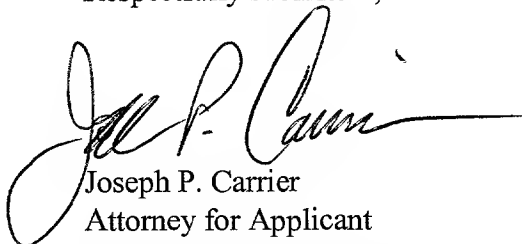
REMARKS

Upon entry of the present amendment, the claims in the application are claims 1-20, of which claims 1 and 18 are independent.

The present preliminary amendment is being voluntarily submitted prior to examination in order to correct minor grammatical errors in the specification, claims and abstract, to include more proper idiomatic form, to eliminate multiple dependencies in the claim, and to present new claims 18-20. Applicant respectfully submits that all of the amendments are fully supported by the original disclosure.

Favorable consideration is respectfully requested.

Respectfully submitted,



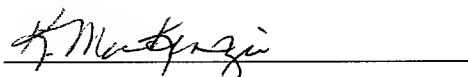
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CERTIFICATE OF MAILING

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AIR BAG SYSTEM

BACKGROUND OF THE INVENTION

Field of the Invention

5 The present invention relates to an air bag system in an instrument panel in front of a front occupant seat.

More particularly, the air bag system can inflate to a designed inflation, even if there exists an obstacle near the instrument panel for restraining an occupant at a front seat. The present invention can provide less impact to the obstacle and maintain the occupant restraining performance, even if there exists no obstacle.

10

DESCRIPTION OF THE RELATED ART

15 The known air bag system includes a folded air bag housed in a storing portion, which is provided in an instrument panel in front of a front passenger seat. The air bag is inflated and inflated toward an occupant quickly by introducing high-pressure gas into the air bag, when a vehicle is crashed for restraining the forward movement of the occupant, which is caused by the inertia force.

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The air bag needs to be inflated smoothly in case that an obstacle is near the instrument panel. For example, the obstacle is a child safety seat facing rearward relative to an inflating direction of the air bag. Even

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if the air bag is brought into contact with the obstacle while the air bag is being inflated, the impact imparted to the obstacle by the air bag needs to be reduced. After the air bag is inflated, the configuration of the air bag needs to remain stable.

To cope with this, the following related methods have been used: (a) the air bag is inflated to avoid as much as possible a risk of contact with the obstacle in the inflating direction of the air bag by improving the method of housing the air bag; and (b) the configuration of the air bag is improved so as to avoid the contact with the obstacle when the air bag is inflated.

However, with the method under (a) there exist problems. One such problem is that the load inputted relative to the windshield becomes large when the air bag is inflated. A second problem is that the air bag is not inflated to the designed configuration due to the obstacle, whereby the passenger restraining performance is deteriorated. With the method under (b) there exist problems. One such problem is that the designed passenger restraining performance is deteriorated by the varied configuration after the inflation of the air bag.

SUMMARY OF THE INVENTION

It is an object of the invention that an air bag

system, which may eliminates the problems in the related art, is provided. The above-mentioned object can be achieved by inflating the air bag with a designed inflating configuration to restrain an occupant, even if there exists an obstacle near the instrument panel. Such an inflating configuration provides less impact to the obstacle and maintains a designed passenger restraining performance even if there exists no obstacle.

As a result of intensive studies to attain the object, the inventors have come to a conclusion that the aforesaid problems may be solved by an air bag system, comprising:

an air bag for placement in a folded state under an upper surface of an instrument panel, and for being inflated by an inflator, which is ignited by the signal from the acceleration sensor, when a vehicle is crashed,

wherein the air bag has a pocket disposed at a lower surface of the air bag when the air bag is inflated.

Moreover, in the air bag system hereof, the pocket is located in a position corresponding to a top portion of a child safety seat when the air bag is inflated.

In the air bag system, it is preferable that the location of the pocket corresponds to the location of a top portion of a child safety seat fixed as facing rearward of the vehicle. Since the top portion of the

child safety seat is accommodated in the pocket, the impact that would be imparted to the child safety seat can be relaxed appropriately. And the air bag can be inflated to the designed inflating configuration for restraining the occupant. It is preferable that the pocket is recessed when the air bag is inflated.

In the case that the pocket is designed as the recessed type, the pocket may be fixed to the inside of the upper surface of the air bag with a strap.

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BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a cross-sectional view of a front passenger seat showing how an air bag according to an air bag system of the invention is inflated.

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Fig. 2 is a cross-sectional view of a front passenger seat showing how an air bag according to an air bag system of the invention is inflated to the full extent.

Fig. 3 is a perspective view showing an air bag according to a first embodiment of the invention.

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Fig. 4 is a perspective view showing an air bag according to another embodiment of the invention.

Fig. 5 is a perspective view showing an air bag according to a further embodiment of the invention.

Fig. 6 is a perspective view showing an air bag according to still another embodiment of the invention.

Fig. 7 is a perspective view showing an air bag according to yet another embodiment of the invention.

Fig. 8 is a perspective view showing an air bag according to another modified embodiment of the invention.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

An air bag system according to the invention will be described in detail below with reference to the attached drawings.

10 Fig. 1 is a cross-sectional view showing an example of the air bag system according to the invention which is in a inflating process. In this example of the air bag system, a child safety seat is mounted in a front passenger seat as facing rearward as an obstacle.

15 In Fig. 1, the air bag system 1 is housed in an upper portion of an instrument panel 11. The air bag system 1 comprises: an airtight container-like retainer 12 which opens to an upper surface of the instrument panel 11; and lids 13a and 13b which close an upper end opening
20 portion of the retainer 12.

An inflator 14 and an air bag 15 are housed in the interior of the retainer 12. Namely, the interior of the retainer 12 constitutes a housing portion of the air bag in the interior of the retainer 12. The inflator 14
25 is a container which includes a gas generating agent such

as gun powder, and a gas generating agent ignited when a crash of a vehicle is detected through a deceleration of the vehicle. From the gas generating agent, high-pressure gas is rapidly expelled by igniting. In addition, the air bag 15 is a bag which opens at one end thereof. And the air bag 15 is joined airtight in such a manner that gas generated by the inflator is allowed to flow into the air bag 15.

When the vehicle is decelerated abruptly due to a crash or the like the deceleration of the vehicle is detected by an acceleration sensor or the like, and the gas generating agent in the inflator 14 is ignited, whereby a high-pressure gas is rapidly expelled from the inflator 14, and the air bag 15 is pressed against the lower surfaces of the lids 13a and 13b. The lids 13a and 13b then rotate upwardly to thereby open the upper end opening in the retainer 12, and the air bag 15 is inflated through the opening.

While a child safety seat 18 is fixed in a front passenger seat as facing rearward of the vehicle, since a top portion of the child safety seat 18 is accommodated at the position corresponding to the position of a pocket 16 formed in the air bag, the air bag is allowed to be inflated smoothly, without interference from the child safety seat.

The air bag 15 is made of an airtight and soft material such as a woven fabric of nylon. It is preferable that the air bag is formed into a bag-like configuration using polyamide yarns. In addition, it is preferable that
5 heat-resistant rubber or silicone is coated on the inner side thereof.

The pocket 16 is preferably housed in the inside of the air bag, when the air bag 15 is housed within the retainer 12.

10 Fig. 2 is a cross-sectional view showing a state in which the air bag is inflated to the full extent. Since the top portion of the child safety seat 18 is fully accommodated in the pocket 16 formed in the air bag 15, the air bag 15 can retain the designed configuration
15 thereof. In addition, since the top portion of the child safety seat 18 is accommodated in the pocket 16, the impact that would be imparted thereto when the air bag 15 is brought into contact with the child safety seat 18 is reduced. In addition, since the air bag 15 can take the
20 designed configuration even if there exists no obstacle, the passenger restraining performance thereof can be maintained.

The pocket comprises a pocket bag portion and a pocket opening.

25 There is no limitation to the configuration of the

pocket bag portion. A first configuration, for example, is formed in a narrowing shape from the pocket opening toward a bottom portion of the pocket bag portion. A second configuration, for example, is formed in a cylindrical shape, and the shape of the bottom portion of the pocket bag portion is similar to the pocket opening.

To be specific, taken for other examples are such configurations as a semi-cylindrical configuration, a cylindrical configuration with circular bottoms, a conical configuration, a rectangular prism-like configuration and a semi-oval configuration. In addition, it is preferable that the depth of the pocket bag portion be 5 to 30cm when the air bag is inflated to the full extent.

It is not preferable that the pocket depth is less than 5cm, because it would have little effect in protecting the obstacle. It is not preferable that the size of the air bag needs to be enlarged, such as if the depth thereof is more than 30cm.

While there is no limitation to the configuration of the pocket bag portion, slit-like, circular, rectangular and oval configurations are preferable. The pocket opening may be sized such that the top portion of a child safety seat is allowed to be accommodated in the air bag when the air bag is inflated. The area thereof

is preferably in the range from 450 to 900cm² when the air bag is inflated.

It is preferable that the pocket is located at a position corresponding to the location of the top portion
5 of the child safety seat facing rearward of the vehicle, whereby an obstacle such as the top portion of the child safety seat can be protected smoothly when the air bag is inflated.

In addition, a material of the pocket bag portion
10 may be the nylon woven fabric, which is similar to the material of the air bag. One other suitable material may be rubber, which has flexibility.

It is preferable that a pocket bag portion is made as a separate component, which is joined to the air bag
15 to produce a pocket. The air bag includes a pocket opening in a lower panel of the air bag to make a pocket. Thereafter, the mouth portion of the pocket opening is joined to the mouth portion of the pocket bag portion. The joining method for connecting the mouth portions together can be
20 implemented through a sewing method, a bonding method through thermal fusion, or an adhesive method. However, the sewing method is preferable to join the mouth portions together. A polyamide suture is preferably used for the sewing method. In addition, joining or sewing a plurality
25 of panels together according to the configuration thereof

may produce the pocket bag portion.

An example of the air bag according to the invention will be described with reference to the attached drawings.

Fig. 3 is a perspective view showing an example
5 of an air bag in which a recessed type pocket is formed therein when the air bag is inflated to the full extent. As shown in Fig. 3, the recessed type pocket denotes a pocket which is formed in such a manner as to enter the air bag when the air bag is inflated. The pocket of the
10 air bag 2 comprises a longitudinal slit-like pocket opening 22 relative to a direction in which the air bag is inflated and a pocket bag portion 21 which is constructed by sewing two angled panels together. The pocket can be produced by forming the slit-like pocket opening 22 in a lower
15 panel of the air bag and sewing together the mouth portion of the pocket opening portion 22 and the mouth portion of the pocket bag portion 21.

Furthermore, a vent hole (an exhaust hole) is preferably formed in the air bag for exhausting gas.

20 The impact that would be caused when the top portion of the child safety seat enters the pocket to be accommodated therein can be relaxed quickly by forming the vent hole in a side of the air bag in the vicinity of the pocket.

25 In this air bag 2, as shown in Fig. 3, vent holes

23a and 23b are formed in both sides of the air bag in the vicinity of the pocket.

Fig. 4 is a perspective view showing another example of an air bag in which a recessed type pocket is formed therein when it is inflated to the full extent. The pocket of the air bag 3 comprises a transverse slit-like pocket opening 32 formed relative to a direction in which the air bag is inflated and a pocket bag portion 31 which is constructed by sewing together two semi-cylindrical panels. The pocket can be produced by forming the slit-like opening 32 in the lower panel of the air bag and sewing together the mouth portion of the slit-like opening 32 and the mouth portion of the pocket bag portion 31.

Since the air bags are inflated with the slit-like pockets 22 and 32 remaining closed in a case where there exists no obstacle, the passenger restraining performance equivalent to that of the air bag with no pocket can be provided.

On the contrary, in case there exists an obstacle, since the pocket openings 22 and 32 are opened to accommodate therein the obstacle, the air bag can be inflated to the designed inflating configuration to restrain the passenger while the impact to the obstacle can be relaxed appropriately.

Fig. 5 is a perspective view of an example of an air bag in which a recessed type semi-cylindrical pocket is formed in the air bag when it is inflated to the full extent. The pocket of the air bag 4 can be produced by forming a rectangular pocket opening 42 in the lower panel of the air bag and sewing a rectangular panel 41 to longer sides of the pocket opening 42 and both side panels as shown in Fig. 5.

Fig. 6 is a perspective view showing another example of an air bag in which a recessed type pocket is formed in the air bag when it is inflated to the full extent. The pocket of the air bag 5 comprises a circular pocket opening 52 and a pocket bag portion 51 which is formed into a conical configuration. The pocket can be produced by forming the circular opening 52 in the lower panel of the air bag and sewing the mouth portion of the circular opening 52 and the mouth portion of the pocket bag portion 51 together.

In addition, in the case of the recessed type pocket, it is preferable to fix the pocket bag portion and the inside of the upper panel in order to make stable the configuration of the recessed type pocket. It is preferable to use a strap to implement the aforesaid fixation. Fig. 7 is a perspective view of an example of an air bag in which a pocket opening 62 is formed into

a longitudinal slit-like configuration when the air bag is inflated to the full extent and in which a recessed type pocket bag portion 61 is fixedly sewed to the inside of an upper panel of the air bag via a strap 63. The
5 pocket can be produced by fixedly sewing the pocket bag portion 61 provided with the strap 63 to the inside of the upper panel of the air bag, forming the slit-like opening 62 in the lower panel of the air bag and sewing together the mouth portion of the slit-like opening 62
10 and the mouth portion of the pocket bag portion 61.

It is preferable that the strap 63 is sewed to a bottom portion of the recessed type pocket bag portion 61 at one end thereof, and at the other end thereof in the vicinity of the pocket, it is preferred that the strap
15 be sewn to the inside of the upper panel of the air bag.

While it is preferable that the pocket becomes recessed when the air bag is inflated, the pocket may become protruded when the air bag is inflated. As has been described before, the pocket is accommodated in the
20 state in which it is contained inside the air bag in the state in which the air bag is folded up in the retainer. Consequently, the air bag in which the pocket becomes protruded is an air bag in which the pocket accommodated in the interior of the air bag is reversed to become
25 protruded when the air bag is inflated, in case there

exists no obstacle. However, in case a child safety seat, for example, is placed facing rearward in the front passenger seat, since the air bag is brought into contact with the top portion of the child safety seat in the inflating process before the pocket is protruded, the pocket is thereby be forced into the air bag, and the air bag can be inflated while the impact to the child safety seat is minimized.

Fig. 8 is a perspective view showing an example of an air bag in which a protruded type pocket is formed in the air bag when it is inflated. The pocket of the air bag 7 comprises a pocket opening 72 which is formed into a longitudinal slit-like configuration relative to a direction in which the air bag is inflated and a pocket bag portion 71 which is constructed by sewing together two angled panels. The pocket can be produced by forming the slit-like opening 72 in the lower panel of the air bag and sewing together the mouth of the slit-like opening 72 and the mouth portion of the pocket bag portion 71.

It is preferable to form a vent hole (an exhaust hole) even in the air bag in which the protruded type pocket is formed as the impact resulting when the top portion of the child safety seat is accommodated in the air bag can be relaxed quickly.

Note that while the embodiments of the invention

have been described with the child safety seat being placed to face rearward as an obstacle, the invention is not limited thereto. According to the invention, even in case the child stands near the instrument panel, the air bag
5 can be inflated while reducing the impact to the child.

Thus, while the air bag system according to the invention has been described with reference to the appended drawings, the invention is not limited thereto, and various modifications can be made to the air bag system without
10 departing from the spirit and scope of the invention.

As has been described in detail, with the air bag system according to the invention, since the pocket is formed in the lower surface of the air bag when it is inflated, even if an obstacle exists near the instrument
15 panel, the obstacle can be received in the pocket, and therefore the air bag can be inflated to the desired inflating configuration to thereby restrain the passenger as designed, and the impact to the obstacle can also be reduced. In addition, even if there exists no obstacle,
20 the designed passenger restraining performance can be maintained. The air bag system according to the invention may preferably be used as a front passenger air bag system.

WHAT IS CLAIMED IS:

1 1. An air bag system comprising:
2 an air bag for placement in a folded state under
3 an upper surface of an instrument panel of a vehicle,
4 and for being inflated by an inflator when the vehicle
5 is crashed,

6 wherein the air bag has a pocket disposed at a lower
7 surface of the air bag when the air bag is inflated.

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1 2. Theairbagsystemaccordingtoclaim1, wherein
2 the pocket is located in a position corresponding to a
3 top portion of a child safety seat when the air bag is
4 inflated.

1 3. Theairbagsystemaccordingtoclaim1, wherein
2 the pocket is located in a position corresponding to a
3 top portion of a child safety seat mounted on an occupant
4 seat while facing rearward of the vehicle when the air
5 bag is inflated.

1 4. Theairbagsystemaccordingtoclaim1, wherein
2 the air bag further comprises an exhaust hole located
3 in the vicinity of the pocket for exhausting a gas.

4

1 5. Theairbagsystemaccordingtoclaim1, wherein
2 the pocket is housed inside of the air bag when the air
3 bag is in said folded state.

1 6. Theairbagsystemaccordingtoclaim1, wherein
2 the pocket is recessed from the lower surface of the air
3 bag, and wherein the pocket comprises:

4 a pocket bag portion having a predetermined depth
5 when the air bag is inflated;

6 a pocket opening portion for receiving a top of
7 a child safety seat, said pocket opening portion having
8 a predetermined opening area; and

9 a strap connecting an inside of an upper surface
10 of the air bag with a bottom of the pocket bag portion.

1 7. Theairbagsystemaccordingtoclaim6, wherein
2 the depth of the pocket bag portion is between 5cm and
3 30cm.

1 8. Theairbagsystemaccordingtoclaim6, wherein
2 the opening area of the pocket opening portion is in the
3 range from 450 to 900cm².

1 9. Theairbagsystemaccordingtoclaim6, wherein
2 the strap is sewed to the bottom of the pocket bag portion

1 at one end thereof and to the inside of the upper surface
2 of the air bag at other end thereof.

1 10. Theairbagsystemaccordingtoclaim6, wherein
2 the pocket opening portion is formed in a slit shape.

1 11. Theairbagsystemaccordingtoclaim6, wherein
2 the pocket opening portion is formed in a circular shape.

1 12. Theairbagsystemaccordingtoclaim6, wherein
2 the pocket opening portion is formed in a rectangular
3 shape.

1 13. Theairbagsystemaccordingtoclaim6, wherein
2 the pocket opening portion is formed in an oval shape.

1 14. Theairbagsystemaccordingtoclaim1, wherein
2 the pocket is formed in a conical shape.

1 15. Theairbagsystemaccordingtoclaim1, wherein
2 the pocket is formed in a semi-oval shape.

1 16. Theairbagsystemaccordingtoclaim1, wherein
2 the pocket is formed in a cylindrical shape with a circular
3 bottom opposing a pocket opening portion.

1 17. Theairbagsystemaccordingtoclaim1, wherein
2 the pocket is convexed from the lower surface of the air
3 bag.
4

17. Theairbagsystemaccordingtoclaim1, wherein
the pocket is convexed from the lower surface of the air
bag.

ABSTRACT

In an air bag system in which an air bag is placed under an upper surface of an instrument panel for restraining a passenger by igniting an inflator by a signal
5 from an acceleration sensor when a vehicle is crashed and deploying the air bag with gas generated by the ignition of the inflator, a method for forming a pocket in a lower surface of the air bag when it is inflated.

AIR BAG SYSTEM

BACKGROUND OF THE INVENTION

~~§~~ Field of the Invention

5 The present invention relates to an air bag system in an instrument panel in front of a front occupant seat. [And] More particularly, the air bag system can inflate to a designed inflation, even if there exists an obstacle near the instrument panel for restraining an occupant at a front seat. The present invention can provide less impact to the obstacle and maintain the occupant restraining performance, even if there exists no obstacle.

DESCRIPTION OF THE RELATED ART

15 ^{known} The air bag system included ⁵ a folded air bag housed in a storing portion, which is provided in an instrument panel in front of a front passenger seat. The air bag is inflated and inflated toward an occupant quickly by introducing high-pressure gas into the air bag, when a vehicle is crashed for restraining the forward movement of the occupant, which is caused by the inertia force.

The air bag needs to be inflated smoothly in case that an obstacle is near the instrument panel. For example, the obstacle is a child safety seat facing rearward relative to an inflating direction of the air bag. Even

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if the air bag is brought into contact with the obstacle while
[on] the air bag ^{is being} inflated, the impact imparted to the obstacle
by the air bag needs to be reduced. After the air bag
is inflated, the configuration of the air bag needs to
5 remain stable.

To cope with this, the following related methods
have been ^{used} [taken]: (a) the air bag is inflated to avoid
as much as possible a risk of contact with the obstacle,
in the inflating direction of the air bag by improving
10 the method of housing the air bag; and (b) the configuration
of the air bag is improved so as to avoid the contact
with the obstacle when the air bag is inflated.

However, with the method under (a) there exist
problems. ^{One such} [A first] problem is that the load inputted
15 relative to the windshield becomes large when the air
bag is inflated. A second problem is that the air bag
is not inflated to the designed configuration due to the
obstacle, whereby the passenger restraining performance
is deteriorated. With the method under (b) there exist
20 problems. ^{One such} [A first] problem is that the designed passenger
restraining performance is deteriorated by the varied
configuration after the inflation of the air bag.

SUMMARY OF THE INVENTION

25 It is an object of the invention that an air bag

system, which may eliminate^s the problems in the related art₂ is provided. The above-mentioned object can be achieved by inflating the air bag with a designed inflating configuration to restrain an occupant, even if there exists an obstacle near the instrument panel. Such an inflating ^{Configuration} provides less impact to the obstacle and maintains a designed passenger restraining performance even if there exists no obstacle.

As a result of intensive studies to attain the object, the inventor ^{S have come to} [et al comes into] a conclusion that the aforesaid problems may be solved by an air bag system, comprising:

an air bag ^{for placement} [housed] in a folded state under an upper surface of an instrument panel, and ^{for being} inflated by an inflator, which is ignited by the signal from the acceleration sensor, when a vehicle is crashed,

wherein the air bag has a pocket disposed at a lower surface of the air bag when the air bag is inflated.

Moreover, ^{In} the air bag system ^{hereof,} [includes that] the pocket is located in a position corresponding to a top portion of a child safety seat when the air bag is inflated.

In the air bag system, it is preferable that the location of the pocket corresponds to the location of a top portion of a child safety seat fixed as facing rearward of the vehicle. Since the top portion of the

child safety seat is accommodated in the pocket, the impact that would be imparted to the child safety seat can be relaxed appropriately. And the air bag can be inflated to the designed inflating configuration for restraining the occupant. It is preferable that the pocket is recessed when the air bag is inflated.

In the case that the pocket is designed as the recessed type, the pocket may be fixed to the inside of the upper surface of the air bag with a strap.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a cross-sectional view of a front passenger seat showing how an air bag according to an air bag system of the invention is inflated.

Fig. 2 is a cross-sectional view of a front passenger seat showing how an air bag according to an air bag system of the invention is inflated to the full extent.

Fig. 3 is a perspective view showing an air bag according to ^{a first} ~~an~~ embodiment of the invention.

Fig. 4 is a perspective view showing an air bag according to ^{another} ~~an~~ embodiment of the invention.

Fig. 5 is a perspective view showing an air bag according to ^{a further} ~~an~~ embodiment of the invention.

Fig. 6 is a perspective view showing an air bag according to ^{still another} ~~an~~ embodiment of the invention.

Fig. 7 is a perspective view showing an air bag according to ^{yet another} [an] embodiment of the invention.

Fig. 8 is a perspective view showing an air bag according to ^{another modified} [an] embodiment of the invention.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

An air bag system according to the invention will be described in detail below with reference to the attached drawings.

10 Fig. 1 is a cross-sectional view showing an example of the air bag system according to the invention which is in a inflating process. In this example of the air bag system, a child safety seat is mounted in a front passenger seat as facing rearward as an obstacle.

15 In Fig. 1, the air bag system 1 is housed in an upper portion of an instrument panel 11. The air bag system 1 comprises: an airtight container-like retainer 12 which opens to an upper surface of the instrument panel 11; and lids 13a and 13b which close an upper end opening
20 portion of the retainer 12.

An inflator 14 and an air bag 15 ^{are} [is] housed in the interior of the retainer 12. Namely, the interior of the retainer 12 constitutes a housing portion of the air bag in the interior of the retainer 12. The inflator 14 is
25 a container which includes a gas generating agent such

as gun powder, and a gas generating agent ignited when
a crash of a vehicle is detected through a deceleration
of the vehicle. ^{From} [In the gas generating agent, high-pressure
~~gas is~~ ^{rapidly expelled} ~~pushed~~ by igniting. In addition, the air bag 15
5 is a bag which opens at one end thereof. And the air bag
15 is joined airtight in such a manner that gas generated
by the inflator is allowed to flow into the air bag 15.

When the vehicle is decelerated abruptly due to a
crash or the like the deceleration of the vehicle is
10 detected by an acceleration sensor or the like, and the
gas generating agent in the inflator 14 is ignited, ^{whereby} a
high-pressure gas is ^{rapidly expelled} ~~pushed~~ from the inflator 14, and the
air bag 15 is pressed against the lower surfaces of the
lids 13a and 13b. The lids 13a and 13b ^{then} rotate upwardly
15 to thereby open the upper end opening in the retainer
12, and the air bag 15 is inflated through the opening.

While a child safety seat 18 is fixed in a front
passenger seat as facing rearward of the vehicle, since
a top portion of the child safety seat 18 is accommodated
20 at the position corresponding to the position of a pocket
16 formed in the air bag, the air bag is allowed to be
inflated smoothly. without interference from the child safety seat.

The air bag 15 is made of an airtight and soft material
such as a woven fabric of nylon. It is preferable that
25 the air bag is formed into a bag-like configuration using

polyamide yarns. In addition, it is preferable that
rubber or ^{heat-resistant} silicone [resistantable heat] is coated on the
inner side thereof.

The pocket 16 is preferably housed in the inside ^{of}
5 the air bag, when the air bag 15 is [housing] ^{housed} within the
retainer 12.

Fig. 2 is a cross-sectional view showing a state
in which the air bag is inflated to the full extent. Since,
the top portion of the child safety seat 18 is fully
10 accommodated in the pocket 16 formed in the air bag 15,
the air bag 15 can retain the designed configuration
thereof. In addition, since the top portion of the child
safety seat 18 is accommodated in the pocket 16, the impact
that would be imparted thereto when the air bag 15 is
15 brought into contact with the child safety seat 18 is
reduced. In addition, since the air bag 15 can take the
designed configuration even if there exists no obstacle,
the passenger restraining performance ^{thereof} can be maintained.

The pocket comprises a pocket bag portion and a pocket
20 opening.

There is no limitation to the configuration of the
pocket bag portion. A first configuration ^{for example,} is formed in
^{shape} narrowing from the pocket opening toward a bottom portion
of the pocket bag portion. A second configuration ^{for example,} is formed
25 in a cylindrical shape, and the shape of the bottom portion

of the pocket bag portion is similar to the pocket opening.

To be specific, taken for [a]nother examples are such configurations as a semi-cylindrical configuration, ^a cylindrical configuration with circular bottoms, ^a conical

5 configuration, ^a rectangular prism-like configuration and

a semi-oval configuration. In addition, it is preferable that the depth of the pocket bag portion be[comes] 5 to 30cm when the air bag is inflated to the full extent.

It is not preferable that the pocket [has] not any effect

10 to protect the obstacle, if the [depth] [thereof] is less ^{than} ~~because it would have little effect in protecting the obstacle.~~ 5cm. It is not preferable that the size of the air bag needs to be enlarged, ^{such as} if the depth thereof is more ^{than} 30cm.

While there is no limitation to the configuration of the pocket bag portion, [a] slit-like, circular,

15 rectangular and oval configurations are preferable. The

pocket opening may be sized such that the top portion of a child safety seat is allowed to be accommodated in the air bag when the air bag is inflated. The area thereof is

[results] preferably in the range from 450 to 900cm² when
20 the air bag is inflated.

It is preferable that the pocket is located at a position corresponding to the location of the top portion of the child safety seat facing rearward of the vehicle, whereby an obstacle such as the top portion of the child

25 safety seat can be protected smoothly when the air bag

is inflated.

In addition, a material of the pocket bag portion may be the nylon woven fabric, which is similar to the material of the air bag. ^{Other Suitable} [The] other material [thereof] may
5 be rubber, which has flexibility.

It is preferable that ^{which is joined to the air bag to} [preparing] a pocket bag portion ^{is made} as a separate component ^{for connecting} [between] a pocket. The air bag includes a pocket opening in a lower panel of the air bag to make a pocket. Thereafter, the mouth portion of
10 the pocket opening is joined to the mouth portion of the pocket bag portion. The joining method ^{for connecting} [between] the mouth portions together can be implemented through a sewing method, a bonding method through thermal fusion, ^{or} [and] an adhesive method. However, The sewing method is preferable
15 to join ^{for connecting} [between] the mouth portions together. A polyamide suture is preferably used for the sewing method. In addition, joining or sewing a plurality of panels together according to the configuration thereof may produce the pocket bag portion.

20 An example of the air bag according to the invention will be described with reference to the attached drawings.

Fig. 3 is a perspective view showing an example of an air bag in which a recessed type pocket is formed therein when the air bag is inflated to the full extent. As shown
25 in Fig. 3, the recessed type pocket denotes a pocket which

is formed in such a manner as to enter the air bag when the air bag is inflated. The pocket of the air bag 2 comprises a longitudinal slit-like pocket opening 22 relative to a direction in which the air bag is inflated and a pocket bag portion 21 which is constructed by sewing two angled panels together. The pocket can be produced by forming the slit-like pocket opening 22 in a lower panel of the air bag and sewing together the mouth portion of the pocket opening portion 22 and the mouth portion of the pocket bag portion 21.

Furthermore, a vent hole (an exhaust hole) is preferably formed in the air bag for exhaust^{ing} gas.

The impact that would be caused when the top portion of the child safety seat enters the pocket to be accommodated [in place] therein can be relaxed quickly by forming the vent hole in a side of the air bag in the vicinity of the pocket.

In this air bag² [2], as shown in Fig. 3, vent holes 23a and 23b are formed in both sides of the air bag in the vicinity of the pocket.

Fig. 4 is a perspective view showing another example of an air bag in which a recessed type pocket is formed therein when it is inflated to the full extent. The pocket of the air bag 3 comprises a transverse slit-like pocket opening 32 formed relative to a direction in which the

air bag is inflated and a pocket bag portion 31 which is constructed by sewing together two semi-cylindrical panels. The pocket can be produced by forming the slit-like opening 32 in the lower panel of the air bag and sewing together the mouth portion of the slit-like opening 32 and the mouth portion of the pocket bag portion 31.

Since the air bags are inflated with the slit-like pockets 22 and 32 remaining closed ^a ^{where} in case there exists no obstacle, the passenger restraining performance equivalent to that of the air bag ^{with no pocket} can be provided. On the contrary, in case there exists an obstacle, since the pocket openings 22 and 32 are opened to accommodate therein the obstacle, the air bag can be inflated to the designed inflating configuration to restrain the passenger while the impact to the obstacle can be relaxed appropriately.

Fig. 5 is a perspective view of an example of an air bag in which a recessed type semi-cylindrical pocket is formed in the air bag when it is inflated to the full extent. The pocket of the air bag 4 can be produced by forming a rectangular pocket opening 42 in the lower panel of the air bag and sewing a rectangular panel 41 to longer sides of the pocket opening 42 and both side panels as shown in Fig. 5.

Fig. 6 is a perspective view showing another example of an air bag in which a recessed type pocket is formed in the air bag when it is inflated to the full extent. The pocket of the air bag 5 comprises a circular pocket opening 52 and a pocket bag portion 51 which is formed into a conical configuration. The pocket can be produced by forming the circular opening 52 in the lower panel of the air bag and sewing the mouth portion of the circular opening 52 and the mouth portion of the pocket bag portion 51 together.

In addition, in the case of the recessed type pocket, it is preferable to fix the pocket bag portion and the inside of the upper panel in order to make stable the configuration of the recessed type pocket. It is preferable to use a strap to implement the aforesaid fixation. Fig. 7 is a perspective view of an example of an air bag in which a pocket opening 62 is formed into a longitudinal slit-like configuration when the air bag is inflated to the full extent and in which a recessed type pocket bag portion 61 is fixedly sewed to the inside of an upper panel of the air bag via a strap 63. The pocket can be produced by fixedly sewing the pocket bag portion 61 provided with the strap 63 to the inside of the upper panel of the air bag, forming the slit-like opening 62 in the lower panel of the air bag and sewing together

the mouth portion of the slit-like opening 62 and the mouth portion of the pocket bag portion 61.

It is preferable that the strap 63 is sewed to a bottom portion of the recessed type pocket bag portion

5 61 at one end thereof, and at the other end thereof ^{to} in the vicinity of the pocket, ^{it is preferred that the strap be sewn to} on the inside of the upper panel of the air bag.

While it is preferable that the pocket becomes recessed when the air bag is inflated, the pocket may
10 become protruded when the air bag is inflated. As has been described before, the pocket is accommodated in the state in which it is ^{contained} stayed inside the air bag in the state in which the air bag is folded up in the retainer. Consequently, the air bag in which the pocket becomes
15 protruded is an air bag in which the pocket accommodated in the interior of the air bag is reversed to become protruded when the air bag is inflated, in case there exists no obstacle. However, ^{for example,} in case a child safety seat ^{in the front passenger seat,} is placed ^{as} facing rearward, since the air bag is brought
20 into contact with the top portion of the child safety seat in the inflating process before the pocket is protruded, ^{the pocket is} ^{and} thereby ^{is minimized} forced into the air bag, the air bag can be inflated while the impact to the child safety seat ^{is minimized} being relaxed.

25 Fig. 8 is a perspective view showing an example of

an air bag in which a protruded type pocket is formed in the air bag when it is inflated. The pocket of the air bag 7 comprises a pocket opening 72 which is formed into a longitudinal slit-like configuration relative to a direction in which the air bag is inflated and a pocket bag portion 71 which is constructed by sewing together two angled panels. The pocket can be produced by forming the slit-like opening 72 in the lower panel of the air bag and sewing together the mouth of the slit-like opening 72 and the mouth portion of the pocket bag portion 71.

It is preferable to form a vent hole (an exhaust hole) even in the air bag in which the protruded type pocket is formed as the impact resulting when the top portion of the child safety seat is accommodated in the air bag can be relaxed quickly.

Note that while the embodiments of the invention have been described ^{with} as the child safety seat being placed to face rearward, ^{as an obstacle} the invention is not limited thereto. and According to the invention, even in case the child stands near the instrument panel, the air bag can be inflated while ^{reducing} relaxing the impact to the child.

Thus, while the air bag system according to the invention has been described with reference to the appended drawings, the invention is not limited thereto, and

but various modifications can be made to the air bag system

without departing from the spirit and scope of the invention.

As has been described in detail, with the air bag system according to the invention, since the pocket is
5 formed in the lower surface of the air bag when it is inflated, even if an obstacle exists near the instrument panel, the obstacle can be ^{received} ~~stored~~ in the pocket, and therefore the air bag can be inflated to the desired inflating configuration to thereby restrain the passenger
10 as designed, and the impact to the obstacle can also be reduced. In addition, even if there exists no obstacle, the designed passenger restraining performance can be maintained. The air bag system according to the invention may preferably be used as a front passenger air bag system.

WHAT IS CLAIMED IS:

1. An air bag system comprising:

an air bag ^{for placement} housed in a folded state under an upper
5 surface of an instrument panel ^{of a vehicle, and} and inflated by an inflator
when ^{the} ~~a~~ vehicle is crashed, ^{for being}

wherein the air bag has a pocket disposed at a lower
surface of the air bag when the air bag is inflated.

10 2. The air bag system according to claim 1, wherein
the pocket is located in a position corresponding to a
top portion of a child safety seat when the air bag is
inflated.

15 3. The air bag system according to claim 1, wherein
the pocket is located in a position corresponding to a
top portion of a child safety seat mounted on an occupant
seat while facing rearward of the vehicle when the air
bag is inflated.

20

4. The air bag system according to claim 1, wherein
the air bag further comprises an exhaust hole located
in the vicinity of the pocket for exhausting ^{a gas} ~~an air~~.

25 5. The air bag system according to claim 1, wherein

the pocket is housed inside of the air bag when the air bag is in ^{said} folded state.

6. The air bag system according to claim 1, wherein
5 the pocket is recessed from the lower surface of the air bag, ^{and wherein} the pocket comprises:

a pocket bag portion having a predetermined depth when the air bag is inflated;

10 a pocket opening portion ^{for receiving} [accommodatable] a top of a child safety seat ^{Said pocket opening portion and having} [has] a predetermined opening area;
and

a strap ^{connecting} [connected] an inside of an upper surface of the air bag with a bottom of the pocket bag portion.

15 7. The air bag system according to claim 6, wherein the depth of the pocket bag portion is between 5cm and 30cm.

20 8. The air bag system according to claim 6, wherein the opening area of the pocket opening portion is in the range from 450 to 900cm².

25 9. The air bag system according to claim 6, wherein the strap is sewed to the bottom of the pocket bag portion at one end thereof and to the inside of the upper surface

of the air bag at other end thereof.

10. The air bag system according to claim 6, wherein the pocket opening portion is formed in a slit shape.

5

11. The air bag system according to claim 6, wherein the pocket opening portion is formed in a circular shape.

12. The air bag system according to claim 6, wherein the pocket opening portion is formed in a rectangular shape.

10

13. The air bag system according to claim 6, wherein the pocket opening portion is formed in an oval shape.

15

14. The air bag system according to claim 1, wherein the pocket is formed in a conical shape.

15. The air bag system according to claim 1, wherein the pocket is formed in a semi-oval shape.

20

16. The air bag system according to claim 1, wherein the pocket is formed in a cylindrical shape with a circular bottom opposing ~~to the~~^a pocket opening portion.

25

17. The air bag system according to claim 1, wherein the pocket is convexed from the lower surface of the air bag.

ABSTRACT

An [In an] air bag system in which an air bag is placed under an upper surface of an instrument panel for restraining a passenger by igniting an inflator by a signal from an acceleration sensor when a vehicle is crashed, and deploying the air bag with gas generated by the ignition of the inflator. The air bag has a method for forming a pocket formed in a lower surface of the air bag when it is inflated, to accommodate an obstacle therein, such as the top of a child Safety Seat.

1 18. (New) An air bag for placement in a
2 folded state under an upper surface of an
3 instrument panel of a vehicle, and for being
4 inflated by an inflator when the vehicle is
5 crashed,

6 wherein the air bag is constructed and
7 arranged to have a pocket form in a lower
8 surface thereof when the air bag is inflated,
9 the pocket comprising:

10 a pocket bag portion having a
11 predetermined depth when the air bag is
12 inflated;

13 a pocket opening portion for receiving
14 an obstacle therein, said pocket opening
15 portion having a predetermined opening
16 area; and

17 a strap connecting an inside of an
18 upper surface of the air bag with the
19 pocket bag portion.

1 19. (New) The air bag of claim 18, wherein
2 the air bag further comprises an exhaust hole
3 located in the vicinity of the pocket for
4 exhausting a gas.

5

1 20. (New) The air bag of claim 18, wherein
2 the pocket is located in a position
3 corresponding to a top portion of a child
4 safety seat when the air bag is inflated.